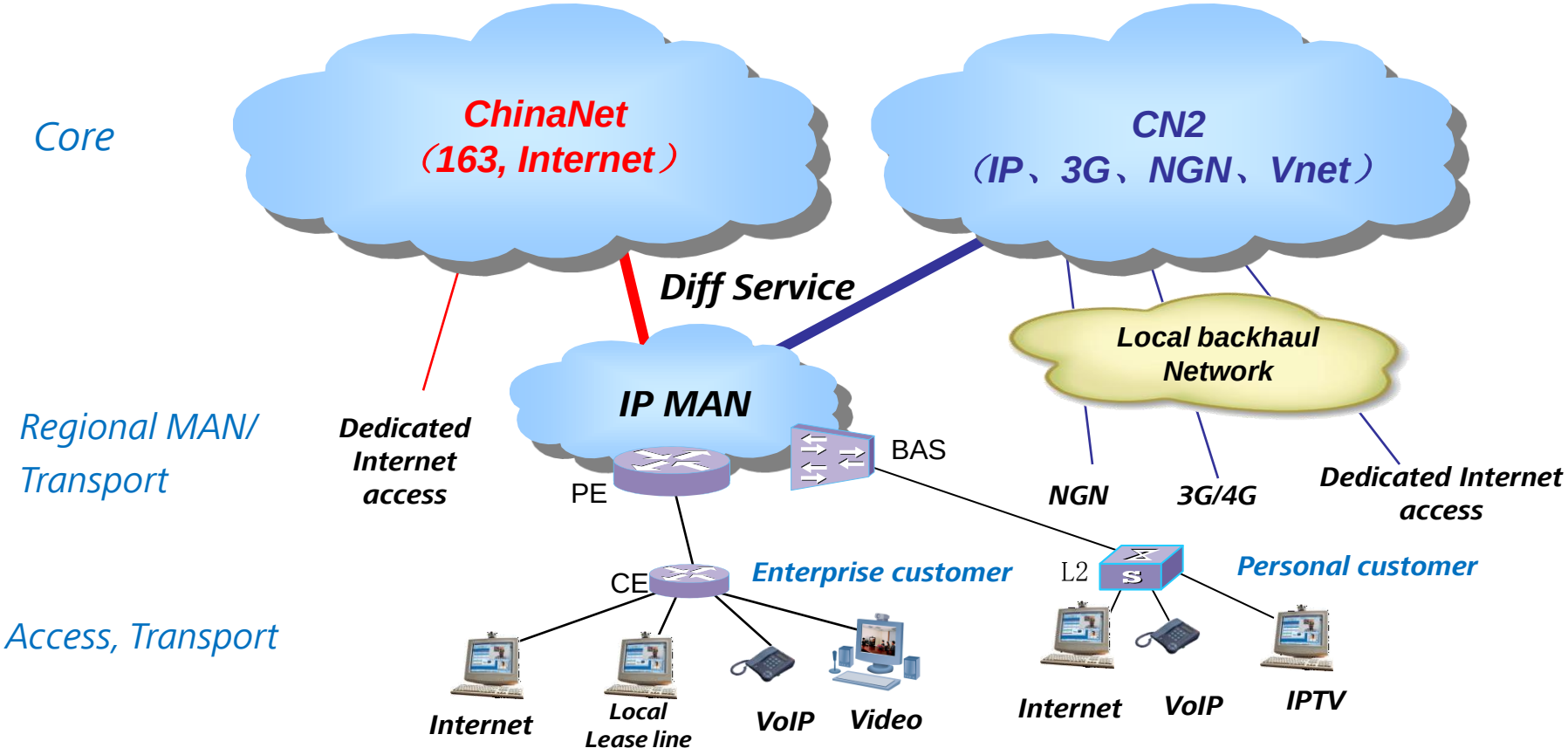
400GbE: Perspective from China Service Provider

Xinyuan Wang, Xin Chang, Huawei Technologies
Lu Huang, China Mobile

Outline

- IP Network Architecture in China
- Traffic Growth of IP Networks in China
- 400GbE for Carrier IP Network in China
- Economic Feasibility of 400GbE
- Summary

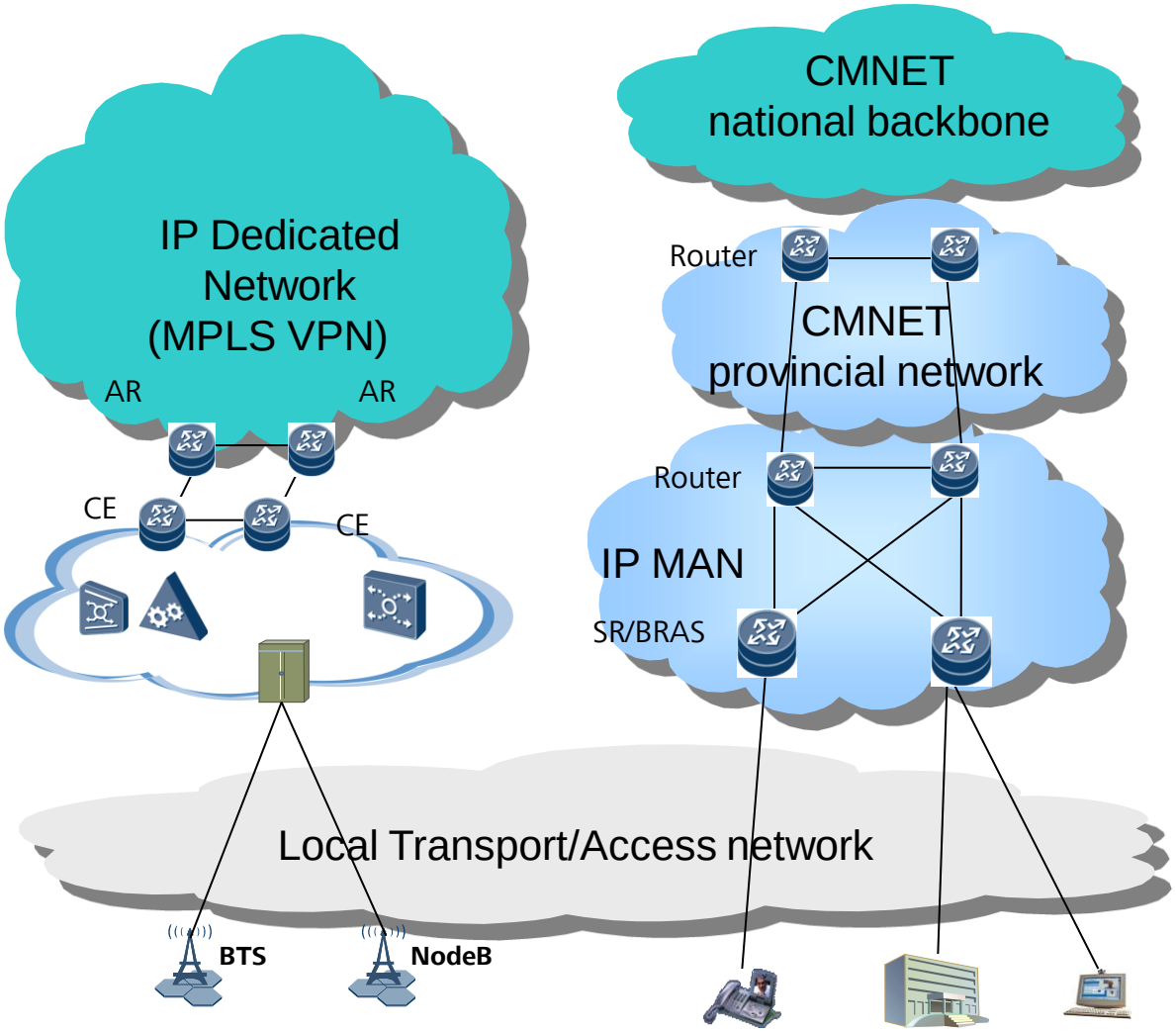
China Telecom IP Network Architecture



- China Telecom is the largest fixed line service provider and 3rd largest mobile telecommunication provider in the People's Republic of China.
  - ChinaNet(163)/CN2: two separate IP backbone network for different service.

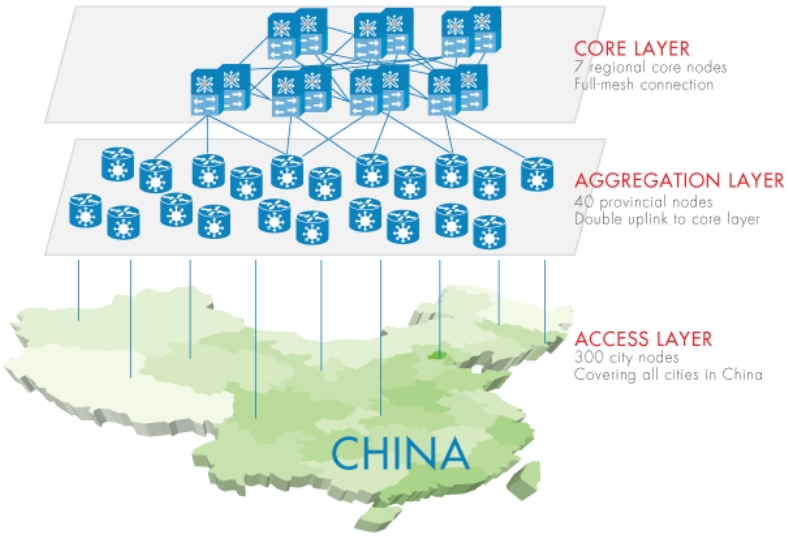
China Mobile IP Network Architecture

- China Mobile is one of the largest mobile network operators in terms of the number of subscribers, and has deployed two IP-based networks for different services/subscribers.
  - CMNet(China Mobile Internet): Internet service with 2-level structure, including national IP backbone and provincial network.
  - IP Dedicated Network: Internal service



China Unicom IP Network Architecture

China Unicom Domestic MPLS-VPN Network



China Unicom Domestic Full Network Coverage

http://www.unicomamericas.com/network/our-network/

- China Unicom is a Chinese state-owned telecommunication operator in China. Compared to other mobile providers, China Unicom is ranked as the world's third-biggest mobile provider.
- China Unicom is the owner of one of China's largest IP networks, China169 network (AS4837), connecting China to the world. The China 169 IP network provides access to the most diversity-routed and highest-capacity IP backbone in the country.

Traffic in China IP Network

- **China Mobile**: bandwidths increasing more rapidly (8 times from 5 Tb/s to 40 Tb/s) from 2009 to 2012, due to the boom in 3G mobile dedicated services.
- Time Division-Long Term Evolution (TD-LTE), will push rapid growth in future.
- To meet the bandwidth demand, China Mobile will roll out 100Gb/s from backbone to metro step-by-step. See prediction in Figure 1.

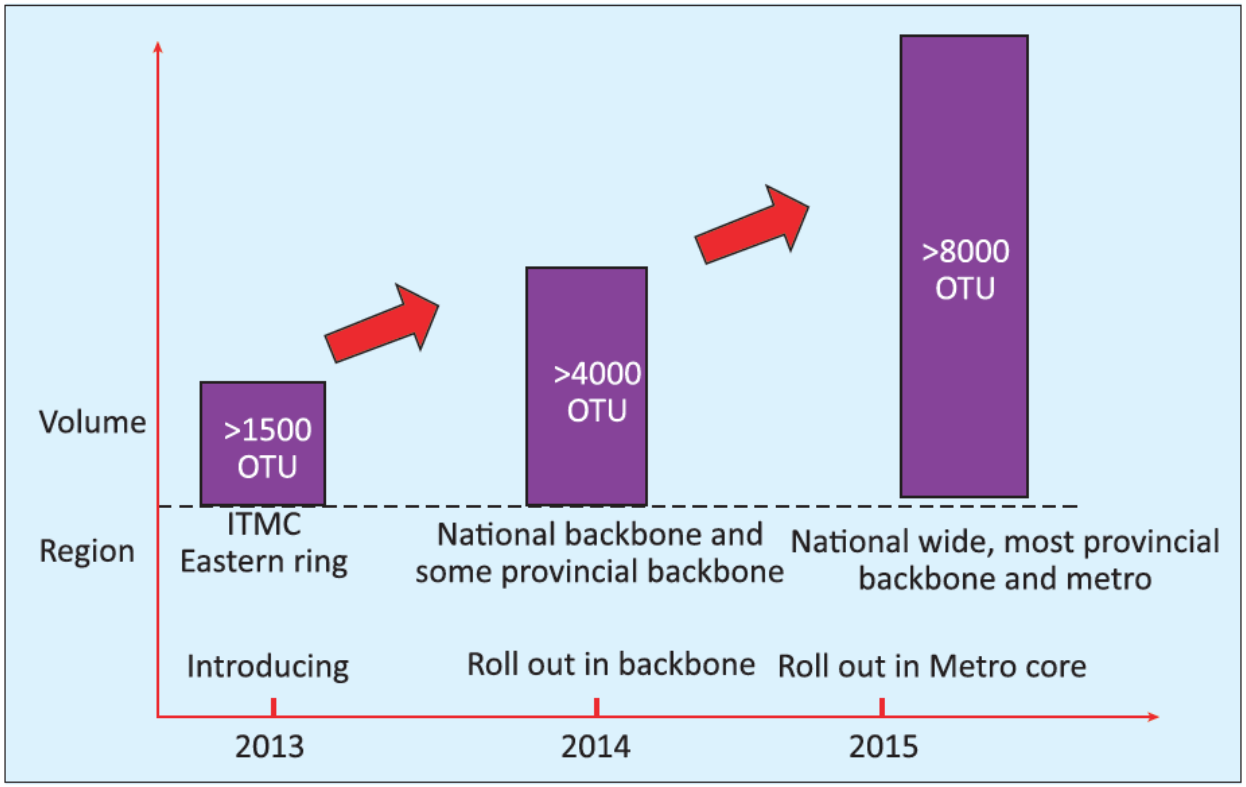


Fig.1 *China Mobile's Roadmap for 100Gb/s deployment*

http://ieeexplore.ieee.org/stamp/stamp.jsp?arnumber=06506928

- **China Telecom:** With the development of Peer-to-Peer (P2P),video, mobile internet, cloud computing and internet of things, the traffic of backbone network is increasing by 56-80% year by year and 10-20 times every five years in China.

The Demand of 400GbE Interface

- Nx100GbE LAG link will be deployed in the backbone by China carrier networks to meet the exploding bandwidth requirements over the next several years!

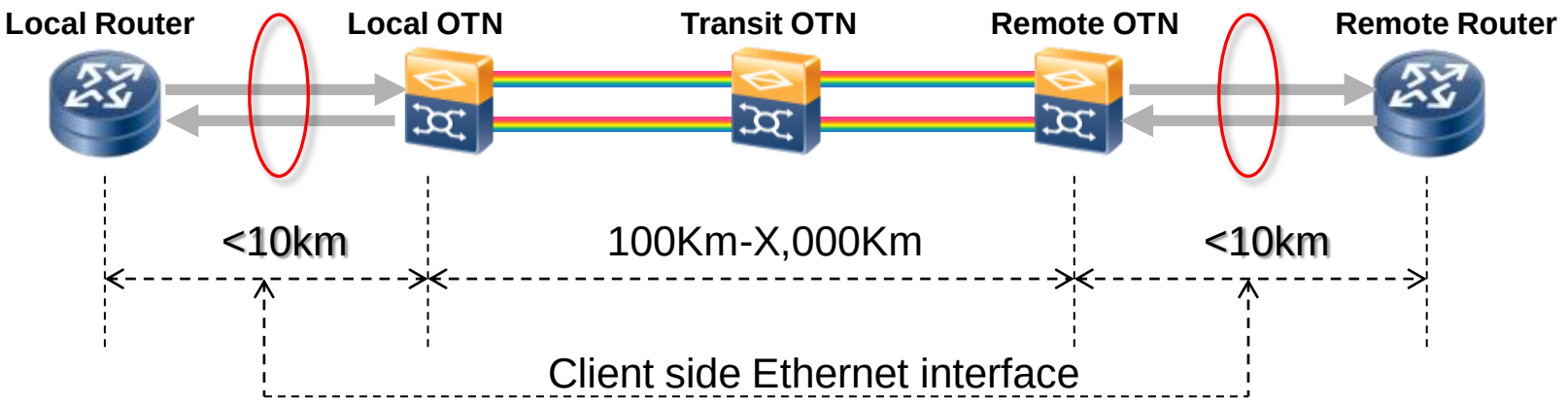
LTE Mobile Internet

Online Video SNS

Data center

Cloud Compute

Link Scenario in China Carrier IP Core Network



- **The interconnection between Core Router and OTN transport is "Outside Building".**
- **For most applications about 2km is required and some of the scenarios may need over 2km.**

Link Scenario in China Carrier Backhaul Network

- Lessons learned from 40GE deployment:

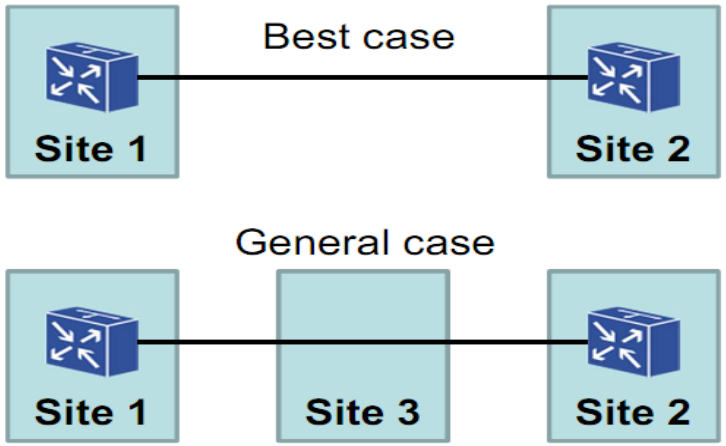
Deployment enviroment of 40GE-ER4

Distribution of link lengths

- In our network, we plan to use 40GE-ER4 mainly for the aggregation ring of the metro PTN network. The following data is from links between aggregation nodes.
- We calculate the distribution of link lengths in Beijing, the result is:
  - For urban area, 60% less than 10km, 20% between 10~20km, 20% between 20~40km
  - For suburban area, the link length will be a little more than urban area
- The other provinces have the similar distribution. For all provinces, the length of 90~95% links are less than 40km.

Connectors number

- Because of using ODF, each site will introduce at least 2 connectors
- For the best case, there will be 4 connectors between nodes
- Generally, the link between two nodes will go across some other sites, so there will be at least 6 connectors



http://www.ieee802.org/3/bm/public/smfadhoc/meetings/oct30_12/huang_01_1012_smf.pdf

400GbE Economic Requirement from Service Provider

Proposal: For the purpose of a broad market potential and economic feasibility in Ethernet backhaul network :

- 100G has begun its large-scale deployment in carriers and research networks in China. It is expected that 100G has the similar life cycle as 10G.
- Total cost of 400GbE interconnect could be efficient compared to 10GbE/40GbE/100GbE LAG solution;
- High cost optical module will limit its broad deployment;
- With gradually increasing deployment of100GbE in the present world wide network, 100GbE optical module market share will also rapidly rise subsequently .
- **The cost of 400GbE client interface should be less than 2~2.5X100GbE with less optical channel compare to 4X100GE optical solution after its volume deployment**

http://www.ieee802.org/3/400GSG/public/13_07/wenyu_400_01_0713.pdf

Summary

- Support 400GbE application in WAN/MAN, IP backhaul interconnect;
- Support OTN interconnect with NO severe impact on existing OTN architecture for system compatibility.
- Support Ethernet Time Synchronization in backhaul application;
- Support the installed SMF fiber infrastructure, no parallel fiber deployed in current IP Core/Backhaul network;
- **Proposed objective:**
  - Define a 400 Gb/s PHY for operation up to at least 40km of SMF, Single pair fiber;
  - Define a 400 Gb/s PHY for operation up to at least 10km of SMF, Single pair fiber;
  - Define a 400 Gb/s PHY for operation up to at least 2km of SMF, Single pair fiber;